# AMENDMENT TRANSMITTAL LETTER

Docket No. M4065.0315/P315

Application	No
09/651.99	8

Filing Date August 31, 2000 Examiner H. Tsai

Art Unit 2812

blicant(s): Lingyi A. Zheng et al.

Invention: METHOD AND STRUCTURE FOR REDUCING LEAKAGE CURRENT IN CAPACITORS

### TO THE COMMISSIONER FOR PATENTS

Transmitted herewith is an Amendment Under 37 CFR 1.116 in the above-identified application.

		CLAIM	S AS AMEND	ED				
	Claims Remaining After Amendment	Highest Number Previously Paid	Number Extra Claims Present		Rate			
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Thomas J. D'Ai Attorney Reg. N								

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Docket No.: M4065.034

## IN THE UNITED STATES PATENT AND TRADEMARK OFFIC

In re Patent Application of: Lingyi A. Zheng et al.

Application No.: 09/651,998

Group Art Unit: 2812

Filed: August 31, 2000

Examiner: H. Tsai

For: METHOD AND STRUCTURE FOR

REDUCING LEAKAGE CURRENT IN

**CAPACITORS** 

### AMENDMENT UNDER 37 C.F.R. § 1.116

ATTN: Box AF

Commissioner for Patents Washington, DC 20231

Dear Sir:

In response to the Office Action dated November 30, 2001 (Paper No. 9 finally rejecting claims 1-59, please amend the above-captioned application as follows

#### In the Claims:

Cancel claims 60-95 without prejudice.

Please replace claims 1 and 40 with amended claims 1 and 40 below.

1. (Amended) A method of forming a capacitor on a substrate in a semiconductor device, comprising:

forming a first layer of a conductive material over said substrate;

forming a second layer of a dielectric over said first layer;

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creating a mixture of hydrogen gas and oxygen gas;

introducing said mixture into a chamber containing said substrate;

introducing nitrous oxide gas into said chamber;

contacting said second layer with said mixture and said nitrous oxide gas so as to form an oxidation layer over said second layer; and

forming a third layer of conductive material over said second layer.

40. (Amended) A method of forming a capacitor structure in a semiconductor device, comprising:

depositing a layer of silicon nitride over a conductive layer formed over a substrate;

creating a mixture of hydrogen gas and oxygen gas;

introducing said mixture into a chamber containing said substrate;

introducing nitrous oxide gas into said chamber;

contacting said silicon nitride layer with said mixture and said nitrous oxide gas so as to form an oxidation layer over said silicon nitride layer.

Please add new claims 96-121 as follows:

96. A method of forming a capacitor on a substrate in a semiconductor device, comprising;

forming a first layer of a conductive material over said substrate;

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forming a second layer of a dielectric over said first layer;

contacting said second layer, during a thermal process, with hydrogen, oxygen and nitrous oxide gases so as to form an oxidation layer over said second layer; and

forming a third layer of conductive material over said second layer.

- 97. The method of claim 96, wherein said second layer is formed to a thickness not exceeding about 60 Angstroms.
- 98. The method of claim 96, wherein said second layer is formed to a thickness not exceeding about 50 Angstroms.
- 99. The method of claim 98, wherein said second layer is formed to a thickness within the range of about 45 to 50 Angstroms.
- 100. The method of claim 96, wherein the ratio of nitrous oxide to oxygen and hydrogen respectively is in the range of about .05 to about 1.7.
- 101. The method of claim 100, wherein said contacting is performed with a gas flow rate of at least about 0.5 slm for said nitrous oxide.
- 102. The method of claim 101, wherein said contacting is performed with a gas flow rate of at least about 2.5 slm for said nitrous oxide.
- 103. The method of claim 102, wherein said contacting is performed with a gas flow rate of at least about 5 slm for said nitrous oxide.

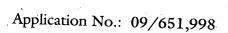
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104. The method of claim 96, wherein said contacting is performed at a temperature within the range of about 600 to 1000°C.

105. The method of claim 104, wherein said contacting is performed at a temperature within the range of about 700 to 900 °C.

106. The method of claim 105, wherein said contacting is performed at a temperature within the range of about 700 to 800 °C.

- 107. The method of claim 96, wherein said oxidation layer is formed so as to be thinner than said dielectric layer.
- 108. The method of claim 107, wherein said oxidation layer is formed to a thickness less than about 5 Angstroms.
- 109. The method of claim 107, wherein said oxidation layer is formed to a thickness less than about 3 Angstroms.
- 110. The method of claim 96, wherein said contacting is performed with a gas flow rate within the range of about 1 to 15 slm for each of said hydrogen, oxygen and nitrous oxide gases.
- 111. The method of claim 110, wherein said contacting is performed with a gas flow rate within the range of about 2 to 10 slm for each of said hydrogen, oxygen and nitrous oxide gases.



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112. The method of claim 111, wherein said contacting is performed at a temperature within the range of about 600 to 1000°C.

- 113. The method of claim 112, wherein said contacting is performed at a gas flow rate for said oxygen which is within the range of about 4 to 8 slm.
- 114. The method of claim 113, wherein said contacting is performed at a gas flow rate for said hydrogen which is within the range of about 4 to 8 slm.
- 115. The method of claim 114, wherein said contacting is performed at a gas flow rate within the range of about 4 to 8 slm for each of said oxygen and hydrogen.
- 116. The method of claim 112, wherein said contacting is performed at a gas flow rate within the range of about 2.5 to 10 slm.
- 117. The method of claim 116, wherein said contacting is performed at a gas flow rate within the range of about 6 to 10 slm.
- 118. The method of claim 112, wherein said contacting is performed at a temperature within the range of about 700 to 800°C.
- 119. The method of claim 118, wherein said contacting is performed at a gas flow of about 6 slm for said hydrogen, about 6 slm for said oxygen, and about 2.5 slm for said nitrous oxide.

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120. The method of claim 118, wherein said contacting is performed at a gas flow rate of about 6 slm for said hydrogen, about 6 slm for said oxygen, and within the range of about 1 to 15 slm for said nitrous oxide.

121. The method of claim 118, wherein said oxidation layer is formed to be thinner than said dielectric layer.